FLIGHT
The AIRCRAFT ENGINEER & AIRSHIPS

First Aero Weekly in the World.

Founder and Editor: STANLEY SPOONER

A Journal devoted to the Interests, Practice, and Progress of Aerial Locomotion and Transport

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DIARY OF FORTHCOMING EVENTS

Club Secretaries and others desirous of announcing the dates of important fixtures are invited to send particulars for inclusion in the following list:—

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Mar. 5 .... **Cinematograph films, etc., before C.U.Ae.S.**
Mar. 6 .... **"Sound Detection," by Major Tucker, before R.Ae.S.**
Mar. 7 .... **"Braided Rubber Shock Absorber Cord for Aircraft," by Mr. L. Rowland, before Inst. Ae.E.**
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Mar. 20 .... **Annual Meeting of Inst.Ae.E.**
Mar. 20 .... **"The Report of the Aeronautical Research Committee's Panel on Scale Effect," by Capt. W. S. Farren, before R.Ae.S.**
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April 1 .... **Entries close for Schneider Cup and Gordon Bennett Balloon Races.**
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Aug. 10 .... **Tour de France for Light 'Planes.**

EDITORIAL COMMENT.

AMONG the immediate results of the Imperial Conference held in London during the latter part of last year there are few which, in air matters at any rate, are of greater practical importance than the offer by the Air Council to grant short-service commissions in the Royal Air Force to Dominion candidates. The suggested scheme should make very strongly for closer co-operation between the Mother Country and the Dominions, and may thus be regarded as one very promising phase in the development of an Imperial Air Policy. It is understood that the offer has been extended to Canada, South Africa, Australia, and New Zealand, and that the proposed scheme involves one year's training in Great Britain, four years on the active list, and another four years in the Dominion reserve. Up to the present the only Dominion to make a public statement on the scheme is New Zealand, whose Government, according to *The Times'* correspondent at Wellington, is now considering the proposal. It is sincerely to be hoped that the proposal will be received with favour, not only in the case of New Zealand but also by the Governments of the other Dominions to which the offer has been extended.

Short Service Commissions for Dominion Candidates

A few relatively minor difficulties apart, the scheme appears such a thoroughly sound one as to deserve the widest support, and as it will throw no extra financial burden on the Dominions it may be assumed that they will all express themselves in its favour. Without wishing to enter into such details as will obviously need close consideration, we should like to point out that the acceptance and carrying into effect of the scheme by the Dominions must not mean a reduction in the number of short-service commissions granted to candidates at home. We take it that, as a matter of fact, there is no intention on the part of the Air Council to make any such reduction, and assuming that to be the case we can see nothing but good resulting from the proposal. The advantage of having at all times a reserve of trained pilots throughout the Empire is too obvious to need enlarging upon, and the fact that the Dominions will be able to have available, without extra cost to them-

selves, officers who have recently undergone training and seen service with the Royal Air Force under the most up-to-date conditions and using the latest types of machines and equipment, should ensure the acceptance of the offer made by the Air Council. If and when Imperial air routes come into being, it will, presumably, be possible to arrange for the officers who have passed into the Dominion reserve to be made use of over such routes as fall within their particular sphere. Thus the various Dominions will be able to keep in touch with progressive developments.

* * *

Aviation Meetings in 1924

Under the Official Notices of the Royal Aero Club on p. 118 will be found several very interesting announcements relating to forthcoming aviation projects for 1924. The Racing Committee of the Club has reported on the various events, and the Committee has approved of some of them at least. Thus it is stated that the proposal that this year's race for the King's Cup should be confined to seaplanes has been approved. We understand that it is the present intention of the Royal Aero Club to hold this race for seaplanes and land machines in alternate years. This seems an excellent idea, as it will give the seaplane type of machine a much-needed fillip, while lending variety to what might otherwise gradually become a somewhat monotonous race. At the moment details have not, we understand, been worked out, but it is the intention to hold the race along the South Coast, with probably an out-and-home flight taking place on two consecutive days. Thus the thousands of visitors to towns and watering places along the South Coast would have an opportunity to see the machines, and very considerable general interest could be counted upon, especially if, as may well be the case, compulsory stops are made at suitable towns. It might be objected that the race will scarcely attract any great number of entries, as there are very few privately-owned or civilian seaplanes in existence. While this is, unfortunately, only too true, it is to be hoped that the Air Ministry may be persuaded to permit constructors who have in hand, and completed in time for the race, machines to the order of the Air Ministry, to enter these in the race, the more so as it is for a Cup presented by His Majesty the King. It seems likely that by the time the race is to be held there will be, at the works of various firms, a considerable number of seaplanes, flying boats, and amphibians ready for issue, and if these, or at any rate, some of them, were allowed to take part a most interesting race would undoubtedly result.

It has also been suggested that the Aerial Derby, now for many years held around London, should be transferred to some other locality. While the Aerial Derby around London has become almost an institution, there is no denying the fact that with speeds going up to round about 200 m.p.h., and landing speeds to close on 100 m.p.h., there may be a considerable element of risk in covering 200 miles or so over the outskirts of London, and we must consider ourselves fortunate in having so far been spared the tragedy of a fatal crash during the actual Aerial Derby race. How long this immunity will last no one can say, but, at any rate, it behoves us to take every possible precaution, and that being so there is very strong reason for transferring the venue to some other district where suitable emergency landing grounds may be found all along the course. At present no definite decision has been reached, but it is suggested that the race should be held near some large town in the South.

Proposals have also been made to limit landing speeds of competing machines. With this proposal we are not so sure that we are in agreement. While the landing speeds necessitated with present racing machines are undoubtedly such as to constitute no small element of danger, there is the opposite view: that a designer and his pilot are the best judges of what is and what is not a safe landing speed for the combination of machine, engine, and pilot in question. Let us realise that what might be highly dangerous for one combination might be quite reasonably safe for another. And let us also realise that had landing speeds been the subject of restriction in the past (where pure speed races were concerned) machines would probably never have been produced which would reach the speeds attained by such racers as the Curtiss and Wright and Nieuport-Delage and Gloucestershire machines. With the backward position held by Great Britain in building and flying speed machines, it would, we think, be unwise to prevent really high-speed machines being developed, and that is the effect, or, at any rate, the probable effect, that a limitation of landing speed would have. We are aware that by limiting landing speed there would be an incentive to produce machines with a wide speed range, but so there is under present conditions. A constructor naturally wishes his machine to land as slowly as possible, and uses his discretion as to what is the maximum speed he is prepared to risk. We really do not think it practicable for any one man or body of men to lay down hard and fast rules for landing speed.

With reference to the forthcoming light 'plane competitions, the rules have now been finally settled, and it is hoped that they will be issued within the next few days. The Prize of £3,000 offered by the Air Ministry will be divided into a First Prize of £2,000 and a Second Prize of £1,000, while the Duke of Sutherland is offering a Prize of £500 for a landing competition. We believe this division of prizes to be a good move, as one machine might very easily win (the competitions will be judged on the award of marks) by quite a narrow margin from the next one, which would then go entirely unrewarded. Under the conditions adopted three machines stand a chance of each winning a substantial prize.

* * *

Light Seaplanes?

During his most interesting paper before the Institute of Aeronautical Engineers, published in this issue, Mr. Manning referred to the possibility of producing light seaplanes. The stumbling block appears to be getting machines with such high power-loading over the "hump speed," but Mr. Manning appeared hopeful, and as such a type of machine would be of the greatest possible value, it is to be hoped that experiments will be carried out. The uses to which a light seaplane could be put are, perhaps, even greater than those of the corresponding land machine, and the question of aerodromes and landing grounds would then, in many cases, be solved. Another use for a light seaplane would be for research into shape and disposition of planing surfaces, porpoising, wave-making, etc., all subjects of vital importance to the development of large seagoing seaplanes, and which could be carried out at low cost by the light seaplane, provided it does not "get the hump."

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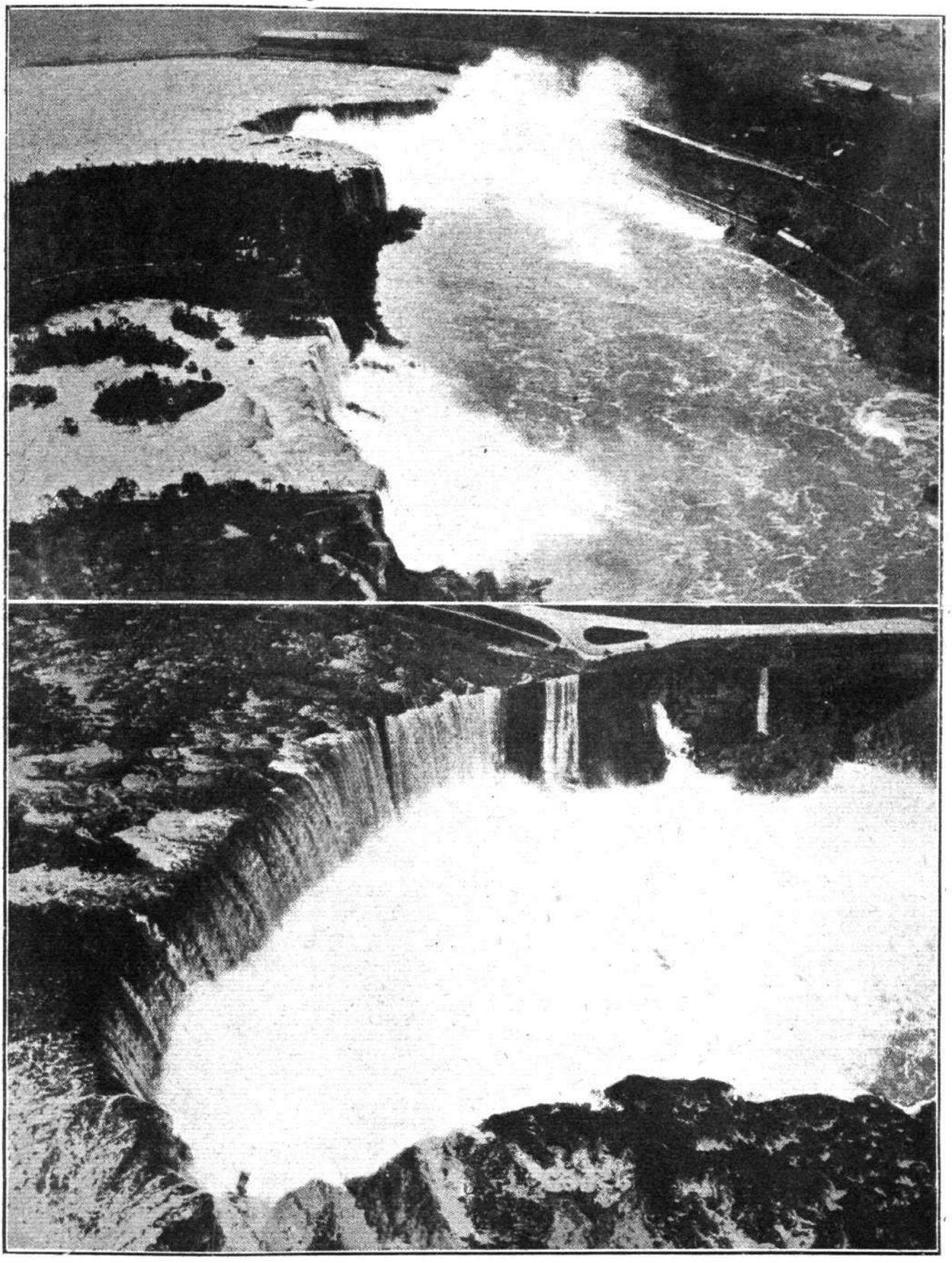
NIAGARA, AS SEEN FROM THE AIR



Two Views of the Great Falls taken by Lieut. A. W. Stevens of the Aerial Photographic Branch of McCook Field, U.S. Air Service.

THE SWANSON-FREEMAN "S S 4" TWO-SEATER BIPLANE

IN our issue for May 17, 1923, we published a description of the Swanson Model 3 Sport 'Plane built by S. Swanson, of Vermillion, South Dakota, U.S.A., and this week we give a brief description of a development of this machine. The new model is known as the Swanson-Freeman "SS 4," and while in general appearance it is similar to the Sport 'Plane, actually it differs from the latter machine in that it is a larger and more powerful 'bus, being, in fact, a "full-sized" two-seater biplane, fitted with an 80 h.p. Le Rhone engine. The Sport 'Plane, it may be remembered, was fitted with a 28 h.p. 2-cyl. horizontally opposed Lawrence engine.

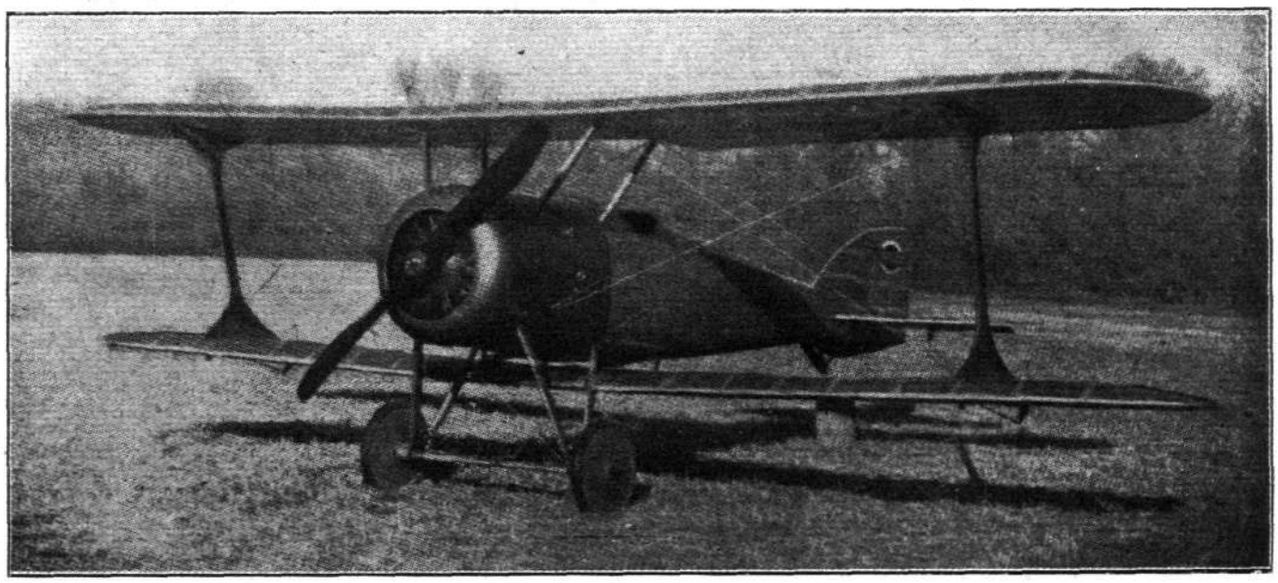
The "SS 4" was first tested on November 11 last by Lieut. M. E. Callender, who took the machine off after a short run, climbed to 2,000 ft. and circled over Vermillion for fifteen minutes, during which time he executed various manœuvres, such as loops, dives, Immelmans, etc. On landing, the pilot reported that it handled like a fighting 'plane, but with more uniform and accurate action, and answered the controls wonderfully. He further stated that with the dual control and side-by-side seating arrangement he thought that he could teach anyone to fly it in a few hours. It "stunted" well and was a good glider.

The tail plane is adjustable from the cockpit, and has one-third of its camber on the lower surface and two-thirds on the upper surface. All control surfaces have a high aspect ratio and are negatively raked. The vertical fin is built integral with the fuselage, a small portion projecting below the fuselage. The control surfaces are provided with a special hinge construction which leaves no gap between the surfaces. All control horns are built into the surfaces, thus eliminating external bracing.

The tail skid is of ash, sprung by the usual rubber shock absorber. The undercarriage is of the Vee type, with a divided axle hinged near the centre. Streamline-section ash is employed for the chassis struts, and the wheels are 26 in. by 3 in. sprung, with the conventional rubber absorber cord; the wheel track is 5 ft.

A 9-cyl. air-cooled Le Rhone 80 h.p. rotary engine is fitted. This engine has been found to throttle down fairly well on this machine. All instruments, viz., switch, altimeter, air speed indicator, rev.-counter, and oil gauge, are mounted on an instrument-board in full view of both pilot and passenger.

This machine is very easily assembled, for once the centre sections are adjusted the wings are self-aligning.



The Swanson-Freeman "SS 4" Two-seater Biplane, fitted with an 80 h.p. Le Rhone engine

With full load this machine takes off in 75 ft., and lands within 150 ft. With the engine running at 900 r.p.m. horizontal flight can be maintained without losing altitude.

The fuselage is of the girder type, built up of spruce and ash, the latter material being employed for the longerons forward of the cockpit. A good streamline shape is obtained by means of basswood fairings. Pilot and passenger are seated side by side, and dual stick and rudder bar control is fitted. A magneto switch is placed on the top of each control stick, and the aileron control cables are carried inside the wings. The petrol tank, which contains sufficient fuel for three hours, is located between the engine and the cockpit. The oil tank has a capacity of 10 gals.

The wings are of the single-bay type, of equal span, with ailerons to upper and lower planes. U.S.A. 27 wing section, set at an angle of 1½° (upper) and 0° (lower), is employed. The planes are set at a dihedral angle of 4°, and given a normal stagger of 1 ft. 8 ins. Both upper and lower planes are in three sections, comprising a centre section and two outer sections, the latter being interchangeable top and bottom. The upper centre section is supported above the fuselage by four struts, and the lower centre section passes below, and is attached to the fuselage. Spars are of routed I-beam section, and the ribs are of built-up truss construction. The wing bracing is of clean design and ample strength, the single I interplane struts being built up of spruce laminations, whilst the single landing wires and double flying wires are 5/32 in. cable.

The principal characteristics of the Swanson "SS 4" are:—

Span	28 ft.
Chord	4 ft. 4 ins.
Gap	4 ft. 10 ins.
Stagger	1 ft. 8 ins.
O.A. length	21 ft. 7 ins.
Height	8 ft. 6 ins.
Wing section	U.S.A. 27.
Angle of incidence (top)	1½°.
Angle of incidence (bottom)	0°
Decalage	1½°.
Dihedral	4°.
Area of main planes	225 sq. ft.
Area of tail plane	16 sq. ft.
Area of ailerons	28 sq. ft.
Area of elevators	11 sq. ft.
Area of fin	5 sq. ft.
Area of rudder	5 sq. ft.
Weight, empty	980 lbs.
Weight, loaded	1,550 lbs.
Weight per horse-power	19 lbs.
Weight per sq. ft.	6.8 lbs.
Speed range	35-95 m.p.h.
Climb per minute	800 ft.
Gliding angle	1 in 10.
Petrol capacity	20 gals.
Oil capacity	10 gals.

◈ ◈

French Air Union Co. Re-formed

THE Compagnie Air Union, which has been operating the French Paris-London, etc., air lines, has been dissolved, and in its place a new company formed, with M. Jacques Level as Chairman and MM. Louis Bleriot, Louis Breguet, and R. Caudron as Directors. The new company will operate the Paris-London line, while the Farman Co. will operate the Paris-Brussels-Amsterdam route.

FLIGHT

RELIABLE FORMULÆ FOR ESTIMATING AEROPLANE PERFORMANCE

REPORT No. 173 of the American National Advisory Committee for Aeronautics, prepared by Walter S. Diehl, contains the derivation and the verification of formulæ for predicting the speed range ratio, the initial rate of climb, and the absolute ceiling of an aeroplane. In addition, the derivation of the formulæ for time of climb and for endurance, is given, while towards the end of the report is given a collection of other formulæ dealing with performance. It is shown in the Report that the ratio of the maximum speed V_M to the minimum speed V_S is given by

$$\frac{V_M}{V_S} = \frac{K_1 \sqrt[3]{\eta_m}}{\sqrt[3]{V_S \cdot \frac{W}{HP}}}$$

where η_m is the maximum propeller efficiency and K_1 is a constant with an average value of 20·3, when V is in m.p.h. and $\frac{W}{HP}$ (the power loading) is in lbs./b.h.p.

The rate of climb at sea level, C_o, is given by

$$C_o = 33000 \left(\frac{K_2 \eta_m}{\left(\frac{W}{HP}\right)} - \frac{(2V_S + V_M)}{1125\ (L/D)} \right)$$

where (L/D) is the overall value for the aeroplane at the angle for best climb (maximum value of (L/D) is to be used) and K_2 is a constant found to be $K_2 = \left(\frac{V_M}{V_S}\right) - 0{,}27$

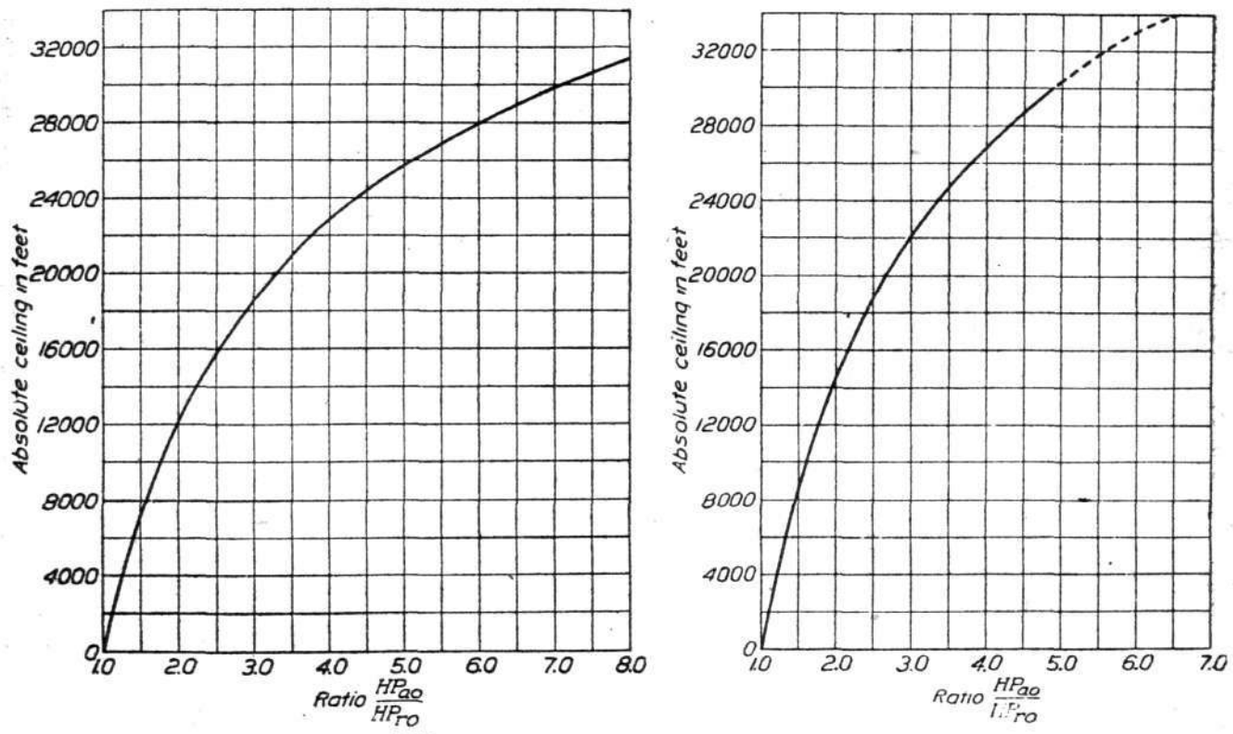
The absolute ceiling is given indirectly by

$$\frac{HP_{ao}}{HP_{ro}} = \frac{K_4 (L/D)}{\left(\frac{1}{\eta_m} \cdot V_S \cdot \frac{W}{HP}\right)^{0.80}}$$

in which K_4 has an average value of 61.7, when V_S is in m.p.h., and $\frac{W}{HP}$ is in lbs./b.h.p. It is to be observed that HP_{ao} is the horse-power available at sea level, and HP_{ro} the horse-power required at sea level. The formula is for use with two curves for absolute ceiling given in American N.A.C.A. Report No. 171. As the formula is of little use without the curves, we have reproduced, from Report No. 171, the two curves, which give the absolute ceiling on a basis of power reserve, *i.e.* $\frac{HP_{ao}}{HP_{ro}}$. It will be observed that the two curves give somewhat dissimilar results. This is due to the fact that the curve on the left refers to the case when the speed of revolution N is proportional to $\left(\frac{p}{p_o}\right)^{0.10}$. The right-hand curve refers to the case when N is constant, as it is sometimes found to be in machines fitted with certain engines. Report No. 171 states that in a surprisingly large number of cases examined the formula $N \left(\frac{p}{p_o}\right)^{0.10}$ was found to hold true, and that in the absence of accurate data on the performance of a particular engine this should be used. It is also stated that a few cases were noted in which N was substantially constant from sea level to the highest altitude reached, and that it is to be expected that in some cases the variation will lie between these limits, *i.e.* the curve of absolute ceiling lie between the two given in the accompanying graphs.

With reference to the formulæ for speed range, initial rate of climb, and absolute ceiling, it is stated that these were developed at the Bureau of Aeronautics of the Navy Department by Mr. Walter S. Diehl, and that they have been used for over a year with gratifying results, particularly in case of the formulæ for speed range and rate of climb. The formula for absolute ceiling, the Report states, has just been developed, and has not been given a thorough verification. However, it appears to fulfil the requirements for accurate work, especially when it is desired to calculate the effect of changes in wing loading and power loading.

In Report No. 173 the value of K_1 in the speed range formula has been determined for each of 30 combinations of wing and power loadings, the former ranging from 4 lbs. to 14 lbs./sq. ft., and the latter from 6 lbs. to 24 lbs./h.p. From these it appears that so long as $\left(\frac{V_M}{V_S}\right)$ is greater than 1.70, K_1 is substantially constant, with an average value of 20·3. The values of K_1 have also been determined from reliable performance data for a number of well-known machines.



Curves of absolute ceiling against $\frac{HP_{ao}}{HP_{ro}}$ (Ratio of horse-power available at ground level to horse-power required at ground level). The curve on the left applies to the case when the revolutions N $\propto \left(\frac{p}{p_o}\right)^{0.10}$. The curve on the right applies to cases where N (*i.e.*, speed of revolutions) is constant. These curves are for use in conjunction with the formula.

The value of K_1 is obviously variable with the type of aeroplane, but the Report states that it is recommended that for the average aeroplane of clean design K_1 be taken as 20·3, and that the figure will probably vary from 19·5 to 21·0, according to design, but that it requires an unusually clean design and high speed-range to secure values of K_1 in excess of 20·5.

It appears that for all machines of ordinary design reasonably accurate results may be obtained, but in the case of a light 'plane, say, a monoplane of very clean design, a value of K_1 very considerably in excess of 20·3 can be obtained. Let us, for the sake of argument, take a light 'plane having a wing loading of 4 lbs./sq. ft. and a power loading of 30 lbs./h.p. The stalling speed of such a machine would probably be about 35 m.p.h. The speed range, $\left(\frac{V_M}{V_S}\right)$, would then be, according to the formula, and assuming a propeller efficiency of 78 per cent., $\frac{20{\cdot}3 \times \sqrt[3]{0{\cdot}78}}{\sqrt[3]{35 \times 30}} = \frac{20{\cdot}3 \times 0{\cdot}92}{1050} = 1{\cdot}84$.

The maximum speed would then be $35 \times 1{\cdot}84 = 64{\cdot}4$ m.p.h. There is little doubt that a modern light monoplane of clean design would have a considerably greater speed range than that, and that values of K_1 of 21 or 22, or even greater, might be obtained. This is, presumably, mainly due to the high value of L/D of light 'planes.

With regard to the formula for intial rate of climb, the Report points out that, as was to be expected, the value of K_2 decreases with increase in $\left(\frac{V_M}{V_S}\right)$. Plotting K_2 against speed range it is found that the points fall on or near to a smooth curve which has the equation

$$K_2 = \left(\frac{V_M}{V_S}\right)^{-0.27}$$

The average value of K_2 is in the neighbourhood of 0·8; thus when the speed range ratio is 2 the value of K_2 is 0·83. When the speed range is 2·25, the value of K_2 is 0·8; and when the range is 2·8 K_2 is 0·78. The Report points out that for very low values of C_o the formula is unreliable, since small percentage errors in either member of the equation may mean large percentage errors in C_o. It is stated that the limiting value of C_o is usually about 400 ft./min.

Little need be said concerning the formula for absolute ceiling. Its derivation is fully dealt with in the Report, and the average value of K_4 is 61·7. In the tables of data given in the Report the extreme variation in the value of K_4 is from 60·2 to 63·2. One of the tables of the Report gives the absolute ceilings calculated by the formula, compared with the absolute ceilings actually obtained with a number of machines, and the agreement is quite satisfactory, especially in view of the fact that in calculating from the formula a constant value L/D = 8 was used. Reference has already been made to the use of the formula in conjunction with the curves published herewith. To show the sort of accuracy obtained we give below the calculated and actual absolute ceilings of a number of machines :—

Aeroplane.	Absolute Ceiling (ft.). Calculated	Actual.
USXBIA	19,800	22,400
M.B. 3	23,500	24,900
M. 80	19,300	19,900
"D"	22,000	23,600
S. 6	15,700	15,100
Roland D. VI-B	19,300	19,000
MS-"AR"	15,400	16,600
D.H.-4..	18,000	17,600
Fokker D. VIII	20,400	22,100
VE-7	18,300	19,000
S.E.-5	18,200	19,800
JN-4H..	18,200	19,000

The service ceiling, *i.e.*, the altitude at which the rate of climb is 100 ft./min., is found from a simple formula. At any altitude the rate of climb is given by the equation

$$C = C_o - C_o \frac{y}{H_a},$$

where Ha is the absolute ceiling, C_o the initial rate of climb, and C the rate of climb at altitude y. At the service ceiling C = 100 and $\frac{y}{H_a} = \frac{C_o - 100}{C_o}$; from which $y = H_s = H_a \frac{C_o - 100}{C_o}$ where H_s is the service ceiling.

The Report containing the derivation of these and other performance estimate formulæ is American National Advisory Committee for Aeronautics, No. 173, and copies can be obtained by application to The Superintendent of Documents, Government Printing Office, Washington, D.C., U.S.A. The price of the Report is 5 cents., and another 5 cents or so should be added for postage.

THE ROYAL AERO CLUB OF THE U.K.

OFFICIAL NOTICES TO MEMBERS.

COMMITTEE MEETING

A MEETING of the Committee was held on Wednesday, February 20, 1924, when there were present: Lieut.-Col. J. T. C. Moore-Brabazon, M.C., M.P., in the Chair; Group-Capt. F. W. Bowhill, C.M.G., D.S.O., R.A.F.; Mr. E. C. Bucknall, Lieut.-Col. M. O. Darby; Col. F. Lindsay Lloyd, C.M.G., C.B.E.; Lieut.-Col. A. Ogilvie, C.B.E.; Lieut.-Col. M. O'Gorman, C.B.; Mr. F. Handley Page; Mr. T. O. M. Sopwith, and the Secretary.

Election of Members.—The following New Members were elected :—

Harold James Andrews.
Kenneth Woodhouse Brewster.
Flying Officer Hubert Steven Redward Burt.
Flying Officer John Francis Bythell.
Edwin Haigh Chalmers.
Pilot Officer John McPhee Darroch.
Charles Frank Day Evans.
Austin Christopher Ferguson.
Anthony Archibald Fletcher.
Flying Officer Arthur Edwin Golds.
Flying Officer Charlton Hallawell.
William Allan Hammerton.
Harry Archer Hince.
Phillip Thomas Hubbard.
Thomas Price Jenkins.
Edward Arnold Jones.
Frank Hazell Jones.
James Morton Leach.
Pilot Officer Francis Richard Lines.
Robert Henry McIntosh.
Allan Lancelot Addison Perry-Keene.
Henry Basil Pett.
Arthur Roach Thomas Pipon.
Pilot Officer Thomas Bain Prickman.
Major Russell Purves.
Jean Baptiste Richard.
George Richardson.
Pilot Officer Reginald Austen Poyntz Roberts.
Archibald Russell.
Flight-Lieut. Norbert Marie Sackville Russell.
Elijah Dudley Salthouse.
Herman Sanders.
Lieut.-Col. Francis Claude Shelmerdine.
Flight-Lieut. Horace Scott Shield.
William Harry Statham.
Elias George Steer.
Capt. David James Stewart.
Charles Tindal Travers.
Frederick Dudley Travers.
Norman Walter Wale.
Pilot Officer Edgar Archibald McKinley-Hay.
Bernard James Malyan.
Cecil George Mathew.
Lewis Motley.
Maurice Ashdown Newnham.
Flying Officer Herbert James Payne.
Herbert Howard Perry.
George Louis Gordon Watson.
Capt. Stanley Frederick Aubrey Welsh.
Flying Officer Charles Bernard Wilson.
Hubert Edward Winch.
Flight-Lieut. Frederick Robert Wynne.

Racing Committee.—Reports of the Meetings of the Racing Committee held on January 28 and February 4, 12 and 18 were received and adopted. The following items were included in the Reports :—

Two-Seater Light Aeroplane Competition, 1924.—The Regulations for the Prize of £3,000 offered by the Air Council were finally approved.

The King's Cup Race, 1924.—Proposal that this year's Race be confined to seaplanes. This was approved.

Aerial Derby.—Proposal to limit the landing speed. Further proposal that the Race should be held away from London, and preferably near a large town in the south, giving facilities for a clear course in the open country.

Beaumont Cup.—The entry of the Gloucestershire Aircraft Co. for the Beaumont Race to be held in France in June next was confirmed.

Late Lieut.-Col. J. L. Travers.—The message of sympathy sent on behalf of the Club was confirmed.

Late Mr. Lawrence B. Sperry.—The acknowledgment of message of sympathy sent on behalf of the Club was received from Mr. and Mrs. E. A. Sperry.

Aviators' Certificates.—The following Aviators' Certificates were granted :—

7950. Harold James Andrews, February 1, 1924.
7951. Donald John Munro. February 5, 1924.
7952. Archibald Russell, May 16, 1918.

Offices: THE ROYAL AERO CLUB,
3, CLIFFORD STREET, LONDON, W. 1.

H. E. PERRIN, Secretary.

FLIGHT

LOW-POWERED FLYING*

By W. O. MANNING

As "The Wren" light aeroplane was the first of its type to fly in England, it might be as well to put on record the origin of this design.

This machine was designed originally at the end of October, 1922, and work was started on it in the beginning of February, 1923, the machine being finally finished and flown early in April the same year. It was not designed for the *Daily Mail* Competition at Lympne, but it was obvious that a machine of this type which was known after its first trials to have a sufficiently good performance for the purpose would have a very good chance in such a competition, and it was therefore entered. The machines which were entered at Lympne followed the lines of the first "Wren" very closely, with the exception of one or two slight alterations which were the result of experience with the first machines. These alterations consisted principally in reducing the dihedral from 4° to 2°, and swinging the wing forward so that the front edge was nearly at right angles to the centre line of the machine instead of sloping backwards as previously. This latter alteration was due to the fact that in the original machine the centre of gravity was somewhat too far forward. In getting out the original design it was clear that in order to make the machine fly satisfactorily with the A.B.C. motor, it was necessary to reduce all the subsidiary resistance to the minimum possible, and it was with this object that the wheels were half buried in the fuselage, thereby suppressing the resistance of the chassis. The wheels had consequently a very narrow wheelbase compared to usual practice, but no trouble due to this has arisen in use.

As the centre of gravity of the machine is only about 18 ins. above the axle, the angle from the centre of gravity to the point where the wheels rest on the ground is probably about normal. It was anticipated that in the case of a bad landing, or in the case of a good landing on a very rough surface, the fuselage would come in contact with the ground, but it was not expected that this would normally damage the fuselage and this expectation has been realised in practice as no structural damage of this nature has ever occurred. In connection with the chassis it may be pointed out that one of the functions of the rather peculiar shape of the nose of the fuselage is to prevent the machine turning over after landing. This nose was stiffened up with three-ply so as to form a broad flat skid, and it would be quite safe to use it as a brake by holding the nose down with the elevator.

As great efficiency was aimed at, and as the machine was small, it appeared reasonable to make the wings of the monoplane type, and the question as to what aspect ratio could be used was given very careful consideration. It is impossible to calculate accurately what the best aspect is under any particular set of circumstances, and the particular aspect selected is really the result of collating all the known facts and then using one's judgment.

It is clear that the higher the aspect ratio the better the L/D of the wings, but if too large an aspect ratio is used the weight of the wings would increase seriously and trouble due to lack of rigidity might be expected. The aspect ratio eventually selected was 9·25 to 1.

The performance of the "Wrens" at Lympne are: Top speed, 52 m.p.h.; minimum speed, 24 m.p.h.; climb about 180 ft. per min. at ground level.

It must, of course, be remembered in the design of machines of this type the question of L/D pure and simple is not the only consideration, as it is in the case of a pure glider. In the glider the performance is independent of the weight, the only effect of pushing up the weight being to increase the size of the machine if loading is to be constant. In the case of the power-driven machine, the performance is dependent on the weight divided by the L/D, which is the resistance, so that in this case weight comes in. It therefore will not pay to put on too much weight by increasing the aspect beyond a certain amount, and, of course, a biplane structure or any other of less actual efficiency, becomes possible if sufficient weight can be saved by its use.

The wings were arranged as pure cantilevers, as on such a design diagonal supporting struts to the wing spars cannot be very satisfactorily arranged for. If they reach to anywhere near the best point of the spar they are very long, and have a very bad angle. If, on the other hand, they are attached to the spars close in, loads are seriously increased owing to negative shears, and, apart from this, although their angle is better, they are not very effective in relieving stresses.

There appears to be no particular difficulty in connection with controls of such machines. A rudder of ample size should be arranged for, and if ordinary practice is followed in connection with elevators and rudders, no trouble need be expected from either of these directions. These small machines have, however, shown one rather important characteristic. Owing probably to the high degree of lateral damping, they do not put one wing down suddenly when stalled, and certain machines of this type, including the "Wren," have been stalled repeatedly without anything whatever happening.

Engines

I think, personally, that it would be advisable to keep to the two-cylinder engine as far as possible. This engine has the advantage of extreme simplicity, and can be overhauled, the valves ground, any cylinders cleansed, etc., at very small cost. An objection one sometimes hears to the use of this type is, that if one plug fails a large proportion of the power vanishes, but this is equally true of any small engine which is likely to be fitted in such machines. Such engines are not likely in any case to have a greater number of cylinders than four, and as a counterpoise to the above, it is clear that as there are twice as many plugs in the latter engine as there are in the two-cylinder type, the risk of failure of one of them is twice as great. In a small engine of this type the irregularity of the torque does not seem to have an appreciably detrimental effect on the propeller, and I think that it would be quite possible to drive a propeller satisfactorily with a single-cylinder only.

Gearing, or Direct Drive

There is another point to which attention may be directed in connection with engines, and that is the question of gearing driving the propeller. The French custom in all their light machines is to run the propeller at not more than about 1,700 r.p.m., and they either use a larger engine than we do and drive direct, or else they use a high-speed engine and gear down, and they seldom use a propeller less than 5 ft. in diameter. At Lympne several machines were fitted with propellers turning up to over 3,000 r.p.m. and about 4 ft in diameter.

I believe that at Lympne the only reason why certain engines were geared was owing to the designers desiring to get more power than could be obtained at a speed practicable or the propeller. Some of the engines used were stated to give their maximum power at 5,000 r.p.m. or so.

There is a good deal to be said for the small diameter high-speed propeller. Though it is obvious that, apart from increase of power, a geared propeller may be considerably more efficient, this is not the only point to consider, though it is clearly a most important one. The high-speed direct-driven propeller is much lighter than the geared one (the "Wren" propeller weighed 1 lb. 11 oz.), and the arrangement is much simpler. Lightness is also assisted by the absence of a gear-box. The small diameter of the high-speed propeller also may enable some resistance to be saved; with its use the wheels may possibly be put in the fuseage, while with a slow-speed propeller a higher chassis which would be heavier and of greater resistance than the alternative may have to be used. It is not a bad general rule when considering two alternative methods of doing something, and if the arguments in favour of each are so balanced as to make it difficult to know which to adopt, to adopt the simplest.

Instruments

The question of instruments for these small machines deserves some consideration, and in this connection it may be stated that the speed indicator used on the "Wren" was slightly heavier than the engine mounting. Very much lighter instruments could and should be provided, and full-size machines would also benefit from a reduction in the weight obtained.

Instruments have not so far given much trouble, the principal trouble with speed indicators being the temptation which is felt by members of the general public to blow down pitot tubes. We had three air speed indicators damaged at Lympne from this cause. Standard engine revolution indicators work well, but are much too heavy, but it is difficult to save much weight on cross levels and certain types of altimeters which are obtainable. The latter, however, are somewhat small. Other instruments are not usually fitted, though when the time comes when it is necessary to fit compasses to small machines of this type, it is clear that a new pattern would be desirable. Something both lighter and smaller than those at present in existence is wanted.

* Abstract of paper read before the Inst. of A.E. on February 22, 1924.

Safety of Light Aircraft

It was clearly shown at the Lympne trials that one of the most important attributes of these light aircraft is their safety in operation, and the safety of any aeroplane is very closely wrapped up with the question of low landing speeds. If one assumes that every landing is going to be made on a perfect aerodrome, and that the pilot will always do his part in a perfect manner, there is no reason why the landing speed of aircraft should not be anything one likes. Practically speaking, engines sometimes fail, and landings have to be made across country, and pilots occasionally make errors of judgment, and it is then that the low-landing speed comes in. If a smash is inevitable, it is not unfair to assume that the chance of injury to any occupant of the aircraft would vary as the amount of kinetic energy contained in his body at the moment the machine hits the ground, and therefore varies as the square of his velocity at this moment. That is to say, if a smash occurs at 25 m.p.h. the chance of serious injury is one fourth of what it would be at 50 m.p.h., or, one may say that any injuries would be only one-fourth as serious.

Another point which makes for safety is that referred to previously, that is, that these machines can be so designed as to be capable of being stalled without the usual sideslip and nose dive which generally accompanies this manœuvre on the ordinary machine. Light aircraft should be entirely free from this trouble.

Those who remember the early days of aeroplanes will remember the early Anzani-Blériot. This machine, which possibly had a top speed of about 35 m.p.h. and a low speed of 28, was certainly very safe to fly. I have seen many smashes in such machines, but never one in which the pilot was hurt. If he was thrown out, and he often was if he made a bad landing, he was never seriously hurt, but, in fact, the usual injury might be described as a slight shaking. When Blériot started fitting 50 h.p. Gnome engines into these machines he flattened out the camber of the wings at the same time, and put the landing speed up to possibly 40 m.p.h. The result to the pilot was that if he was thrown out he generally either broke his neck or suffered from very severe concussion.

All pilots today are used to flying machines which may be considerably faster than 100 m.p.h., and naturally consider machines with top speeds of, say, 70 m.p.h. slow. In fact, it is common to hear that nothing less than 100 m.p.h. is any good for cross-country flying, and that light aircraft will be no practical use until such speeds are attained. I do not agree. Let us consider what sort of machine would be suitable for, say, a ranch-owner in Australia who desires to use it for supervising his ranch involving journeys of, say, 40 miles each. We may assume that he has just taken a course of tuition, and has had little real experience of flying, and that the ranch does not provide good landing grounds, and that any emergency landing ground will be very poor. A very low landing speed is clearly here of optimum importance, as even if this invokes a top speed of only 60 m.p.h., or less, he will save an enormous amount of time over his present method of transport, even in a wind up to 40 m.p.h. Let us not forget that the old Maurice Farman was once one of the best and most-used across country with a top speed of about 54 m.p.h.

The Light Seaplane

There are numerous other possible uses for light aircraft. In Canada machines of usual type are extensively employed for mapping by photography, patrolling forest land for fires, sending parties to fight fires, etc. For these purposes high performance is not required, and it is certain that aircraft can now be produced which will do the work at a much less cost than the machines which they have in use at present. There is, however, one difficulty with Canadian requirements, which is, that in many districts the only landing places available are lakes or rivers, and before full advantage of the new developments can be taken, it will be necessary to produce a light seaplane.

The development of a light seaplane will present many new problems. Compared with the ordinary seaplane, it will unquestionably have to be much more efficient aerodynamically, but its engine power must be sufficient to enable the machine to get over what is known as the hump speed. This speed in the ordinary seaplane usually occurs at about 25 knots. It occurs on all floats and boats so far designed, and although by careful design the resistance at this point may be reduced, the minimum power with which a seaplane can be fitted depends on the amount of power which is necessary to pull the machine over this hump.

In the case of a hull of the Linton-Hope type with a getting-off speed of about 80 knots. this hump resistance is, roughly, 175 lbs. in 1,000 lbs., and to this must, of course, be added the aerodynamical resistance of the machine to get the total resistance ; 50 knots, which is about 57 m.p.h., would possibly be about the cruising speed of a light seaplane, and is much too high for the getting off speed, which might be 30 knots. This latter figure would bring the hump speed of the latter down to, say, 15 knots on a similar design of hull.

These figures are much lower than anything which has so far been tried, but there is no reason to believe that any serious difficulty would arise. The aerodynamical design would present more difficulties. Seaplanes of small size have always been less efficient than the equivalent land machine, while the structure weight has also been greater owing to the weight of floats, etc., and the indications point to the impossibility of getting what is wanted with existing types. Possibly a monoplane flying-boat might be developed which would possess the desired features, but the actual design of such a machine is rather outside the scope of this paper.

Apart from the possibilities of light aircraft coming into extensive use in this country, there are undoubtedly considerable possibilities in the Colonies, and also in such countries as the Argentine. The fathers of the present owners of large ranches and farms made their visits of inspection on horseback at an average speed of possibly 7-8 m.p.h. Many of the present owners probably use Ford motor-cars, and average 10 to 12 m.p.h. The sons of the present owners will probably use light aircraft, and will average 40-50 m.p.h., and the saving of time will be considerable. I am informed that in the Argentine there are ranches which require a journey of 50-60 miles to be made by the owners or manager for one round of inspection.

But before a market can be created in districts like these, it will be necessary to educate the populace in the possibilities of modern light aircraft, and this will take several years. Types specially developed for the requirements of each country may also be necessary.

One of the immediate results of the light 'plane development is that it is now beyond question possible to produce a training machine for the Air Force which in first cost, cost of upkeep, cost of fuel and oil, etc., will save the Air Force many thousands a year, as the items enumerated above will probably not be more than one-third of the present cost, and the principal object of this year's competition is to produce such a machine.

While the Lympne competition may be stated to have shown the way and proved the possibility of improved efficiency, this year's competition represents a unitarian development of the information obtained.

At present, however, many of the designs used at Lympne can only be produced in small sizes, and, although the results obtained there are of enormous value, there are many problems to be solved before we can produce a commercial machine weighing, say, 10,000 lbs., and capable of cruising at 100 m.p.h. with a gliding angle at that speed of 1 in 14, say, which would represent a horse-power of, say, 250 or a horse-power loading of 40 lbs./h.p. That such results and better will eventually be obtained I have not the slightest doubt, and when light single-seater aircraft are produced with a gliding angle of, say, 20 to 25, and of such a form that they can be constructed in a large size without excessive structure weight, such results will be in sight.

There is a certain amount of opinion which considers that experiment with pure gliders is the method of experiment. I do not agree with this. Apart from the practical difficulties, such as difficulty of access to suitable hills, infrequency of suitable winds, the type of development is not what is wanted.

Light aeroplanes can, on the other hand, be flown from any suitable aerodrome, and the choice seems to lie between experimenting with such machines or with models in a wind tunnel. There is not probably much difference in expense between these methods, and although measurements can be made more accurately in a tunnel the light aeroplane tests are not subject to certain possible errors of an unknown magnitude which may occur in tunnel work. Controls can be tested in flight, and any difficulties in connection with them can be more easily discovered and overcome.

I should like to say in conclusion, that to my mind the demonstrated fact that improved aerodynamical efficiency is obtainable is a most important land mark. It remains for us to apply this knowledge to larger machines and to try and overcome the very great structural and other difficulties which willl arise. At the same time, even better results than those reached at Lympne are undoubtedly possible, and should be obtained. The prize money already given has produced results out of all proportions to the cash value of the prizes. Further progress could be stimulated by the same method.

FLIGHT
AIRCRAFT ENGINEER AND AIRSHIPS

SOME FEATURES IN THE PRESENT POSITION OF AERIAL PHOTOGRAPHIC SURVEY*

By H. HAMSHAW THOMAS

AN extremely interesting paper on the above subject was read before the R.Ae.S. by H. Hamshaw Thomas (Fellow of Downing College, Cambridge), on February 21, and as aerial photography offers such great possibilities in a number of ways to an extent, we think, not generally appreciated, we publish this paper below more or less in full.

The author devoted the opening part of his lecture to the work of the late J. C. Griffiths in the investigation of the problems and methods of aerial survey—the results of which work have already been published in the *Geographical Journal* (Vol. LXI, 1923, p. 419) and in reports issued by the Cambridge University Aeronautical Dept. Having pointed out that, when Griffiths started on this subject at the conclusion of the War, aerial survey had become differentiated into two distinct sections with different objects in view: (*a*) To correct and make more accurate the maps of a country whose main features were already well known; (*b*) To produce a useful map of a country whose features were unknown in any detail, but in which a few points had been fixed by previous ground survey, the author outlined Major Griffiths' work as follows:—

"His ideas from the first were to study the possibility of using aerial methods in the survey of new or undeveloped countries which needed to be opened up on account of their natural resources, and so his early interests centred round the type of work which had been done in Palestine.

"One of the fundamental theories underlying the work on this front had been that it is possible for a trained pilot to fly over and photograph a line of country at least five miles long while maintaining an approximately constant height and keeping his machine so level that the plate in the camera would never be tilted through more than 3° to 4°. The experience of the officers who compiled the maps from the photographs in Palestine indicated that, with care, tilts of more than 3° were infrequent, and that tilts of not more than 2° did not greatly damage the value of the work, but surveyors whose experience was chiefly derived from work in France were very sceptical about the possibility of such a performance. They thought that, in general, the Palestine method would be invalidated by the magnitude of the tilts which, in their experience, occurred when a pilot tried to take vertical phtographs.

"Before any further thought could be given to the development of a method like that used in Palestine for survey work in times of peace and for civil purposes, it was necessary to ascertain definitely what was the average performance of a trained pilot when flying on a straight course and trying to keep his height constant and his machine level. It was to this problem that Griffiths first addressed himself, having obtained a research grant from the Department of Scientific and Industrial Research.

"The Air Ministry had allowed Prof. Jones the use of three machines for carrying out research work from Duxford aerodrome in connection with the School of Aeronautics, and arrangements were made to make the above problem one of the objects of research. Under the direction of Prof. Jones, Griffiths worked at this problem for nearly two years, doing most of the experimental work and the reductions of the results, and generally acting as the observer during the flight and manipulating the camera." . . .

"In the first series of experiments a machine was flown over a level strip of country in the Fens which was well mapped, a series of photographs taken and the position of points on the plates compared with the positions of the corresponding points on the ordnance survey map. This involved a long series of accurate measurements on the plates, and a great deal of this devolved upon Griffiths. Apart from the published results and the main objects of the work, it was incidentally shown that a method of map compilation from aerial photographs which involved a series of accurate direct measurements from the plates would be a very laborious process which could not be recommended in cases where a large area had to be covered in an economical way. After two years' work, and the careful measurements of 170 negatives, it was found that, in a machine flown by a trained pilot with all due precaution, the tilt of the camera seldom exceeded 2° from the vertical, and that the change of height from the mean level of each flight seldom varied more than 100 ft., the probable tilt being 1° and the probable variation of height being 40 ft.

"This was the first demonstration of the actual course taken in space by a machine during a flight, and it fully justified the view taken by the survey officers in Palestine as to the performances of a skilled pilot. The importance of this work for the future is that it demonstrates beyond all question that straight and level flying is possible under favourable circumstances within such limits as are required for reasonable accuracy in mapping a large expanse of flat country on a medium scale. It shows that the method of air survey by taking a series of vertical photographs is sound, and that it is therefore worth developing. It also shows that such work requires the employment of good and specially trained pilots; and, finally, that it involves far less labour in the compiling office than any method involving the direct measurement of distances on a photographic plate."

"In the autumn of 1921, after some progress had been made in flights over the Fens, I suggested to Griffiths that he should test his pilots' ability to make a small photographic survey of an area of ground totally unknown to them by taking photographs along three or four parallel lines. The area chosen was Blakeney Harbour on the coast of Norfolk, where a long stretch of shingle and dune land had recently been acquired by the National Trust and where a certain amount of ground survey had recently been done. I knew also that rapid changes had recently gone on in the topography of the shore line, and hoped that we might be able to test the efficiency of aerial survey as a means of charting them.

"The work was carried out in October, and showed that when a pilot had to think of covering a specified area, his flying tended to be less regular, and, conversely, that when he attended to his flying the courses on which he flew were not parallel, and the area was not completely covered by photographs. I remember that this came as somewhat of a surprise to Griffiths and to the pilot, and I believe that this first suggested the second line of inquiry which was then taken up. This was to find out how to fly over an area of ground so as to cover it with a series of straight parallel strips without losing the accuracy obtained in the Fens.

"This research was also carried out jointly with Prof. B. M. Jones, who provided methods derived from his extensive experience in connection with the navigation of bomb-carrying aeroplanes. In this work Griffiths generally acted as observer in the experimental flights, working the camera and making the necessary observations and calculations. It involved the testing of several forms of instruments, and indicated the value of an apparatus designed by the R.A.E. called the Gyro-azimuth, and also of the gyroscopic rudder control apparatus (when it functions correctly, which was not always the case).

"By the elaboration of a system of procedure, allowing for the wind, and using the instruments above mentioned, or even without the gyro rudder control, it was found possible to take photographs along parallel strips over a distance of from 10 to 15 miles without gaps and without losing accuracy. . . . It was found by experience that an area of about 100 square miles could be conveniently covered by a machine in one flight lasting three hours. And, incidentally, it was demonstrated that in a flat country a very good survey could be made at a rapid rate provided that a certain number of points had been fixed by ground survey at distances of about 10 miles apart.

"The next proceeding was to test the efficiency of the method by making an experimental survey of an area of country round Cambridge, 225 miles in extent—a square whose sides were 15 miles long. This area was covered by about two days' flying, and proved the value of the preceding work.

"In connection with this experimental survey the question of map compilation came into consideration. The method employed during the War in Palestine was somewhat long and laborious, for, on account of the very hilly nature of the ground, many systematic errors in the scale of the photographs were introduced which had to be eliminated. It seemed that with an almost flat country and with accurately-taken photographs it might be possible to devise a much more expeditious and easier method Prof. Jones and

* Paper read before the R.Ae.S., Feb. 21.

Major Griffiths put in a considerable amount of work on this problem, and devised a method which is outlined in the *Geographical Journal*, which was comparatively rapid and worked very well. . . . The prints of the Cambridge area were eventually made into a mosaic showing the whole of the 225 miles of country, and this was adjusted to fit the positions of four control points which formed a rough square with 10-mile sides. Having completed the work, the position of the points shown on its various parts was carefully compared with the position of the corresponding points as shown on the ordnance survey map. And it was found that the maximum error of position was never greater than 130 yards, while the errors were generally less than 60 yards. This is a surprisingly good result, since in part of the area the ground was 400 ft. above its level in other parts. Such an area is negligible for practical purposes in reconnaissance maps, say, on a scale of 1-40,000, and is frequently exceeded by the error produced by the change in the dimensions of the paper when an accurate map is mounted on canvas."

The author here briefly described an experiment, as yet unfinished, in surveying a large tract of land rich in timber in the Far East.

"In the course of the Far East experiments, Griffiths had materially assisted in developing a scheme of aerial survey applicable especially to large unexplored tracts of flat country. While possessing the same general characters that had been used in war surveys, it differed in several important respects, viz., that the probable error at each stage was known, the special precautions needed to secure accuracy had been studied, and the instruments which might facilitate the work had been tested. Aerial survey based on vertical photographs was previously empirical; it had now become a systematised science. It is for that reason that I venture to think that the work accomplished has in reality a far greater value than might at first appear, and I am in a position to make this observation owing to my experience in the earliest air surveys on a large scale.

"I must again point out that while much of Cambridge work applies only to flat or comparatively flat countries, and is inapplicable to regions with high mountains, nevertheless it contains many elements which will be of value in the development of methods of survey in such districts. We in England can do little in the investigation of the problems of air survey among mountains, where vertical photographs can only be of local application, but as far as we have had opportunities for research, I believe they have been employed usefully.

Aerial Survey and Our Knowledge of the Surface of the Earth

"I have indicated above one of the main lines along which the development of aerial survey is proceeding, and the other method of work through the employment of oblique photographs has been mentioned.

"Both these methods are being used in practice in Canada, where aerial survey, fostered by Dr. E. Deville, Director-General of Surveys, seems to be in a flourishing condition, though still in the experimental stage."

"Of the two methods referred to, I have myself been mainly interested in the first, and I wish now to try and show why I consider it of such interest and importance. In large stretches of featureless and uniform country the oblique method may possess many advantages, but in other areas the portrayal of the ground in the fullest detail may be of greater utility.

"I think it may reasonably be said that as civilisation and the utilisation of the earth's surface by man proceeds, so a more detailed knowledge of the earth's surface becomes necessary. In former years, maps showing the general features of the earth, such as the main divisions between land and water and the principal mountain ranges, were quite sufficient for man's needs. Then in civilised regions more detailed maps on a scale of about 1 in. to the mile were needed, in which greater detail was shown. But as time passes we need to know more and more detail about our countries, especially as they are opened up by communications, as cultivation, irrigation, mining and forestry operations are commenced upon them. Thus the ideal survey is the one which provides the greatest possible amount of information, obtained with accuracy and despatch.

"Within the period of the Great War the same principle was illustrated in a marked way. The wealth of detail required for the operations in its concluding stages was infinitely greater than what was deemed necessary during the first year. Even in a campaign like that fought in Palestine, the exact knowledge of the contours of the country at every point along certain roads became of vital importance to the plan of operations, instead of a general knowledge of the direction in which those roads ran.

(To be concluded.)

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ROYAL AERONAUTICAL SOCIETY
Official Notices

Election of Members.—The following Members have recently been elected :—

Fellows : J. H. Parkin, J. D. Siddeley.

Associate Fellows : Flight-Lieut. N. Comper, F. J. W. Wingfield Digby, A. A. Quayle, A. H. Leak.

Students : B. Howard, G. Lyon, R. J. Moffett, R. W. Symmons.

Member : T. A. Gladstone.

Associate Member : A. G. Lamplugh.

Foreign Members : Major N. Brearley, R. T. Hurley.

Journals.—The February number of the Journal of the Royal Aeronautical Society contains "The Thermo-Dynamics of Aircraft Engines," by H. R. Ricardo, and "The Aerodynamical Characteristics of the Airship as Deduced from Experiments on Models" ("R.38" Memorial Prize Paper), by R. Jones.

Lecture.—The next lecture will take place at 5.30 p.m. on March 6, at the Royal Society of Arts, 18, John Street, Adelphi, when Major Tucker, R.E., of Woolwich Arsenal, will read a paper on "Sound Reception."

Annual General Meeting.—The Annual General Meeting of voting Members of the Royal Aeronautical Society will be held at 7, Albemarle Street, at 5 p.m. on March 27.

W. LOCKWOOD MARSH, Secretary

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The Royal United Services Institution and Aviation

ON February 20 Air Commodore R. H. Clark Hall, read a paper before the above Institution on "The Value of Civil Aviation as a Reserve to the Royal Air Force in the Time of War."

Air transport lines, the lecturer stated, would form the backbone of civil aviation, but they must be subsidised until they became a commercial proposition. At present civil aviation could not constitute a reserve, as it was not large enough, and it was not large enough because it did not pay. There were three stages in the progress of new inventions for increasing rapidity of communication—experiment, accompanied by scepticism, ridicule, and opposition; development in the form of reliability and economical working; and then expansion. We had now got over the stage of ridicule, and were in the development stage, which, he thought, would end in its being a valuable reserve for the fighting Service.

Aero Golfing Society

THE Winter Meeting will take place at Coombe Hill Golf Club on Thursday, March 6, 1924, for the Challenge Cup presented by Sir Samuel Instone.

The following players have so far entered :—Lieut.-Col. J. T. C. Moore-Brabazon, M.C., M.P., Sir Henry White Smith, C.B.E., Air Vice-Marshal Sir Vyell Vyvyan, K.C.B., D.S.O., Lieut.-Col. F. C. Shelmerdine, O.B.E., Flight-Lieut. D. FitzGibbon, Capt. A. Newman, Major R. H. Mayo, A. J. A. W. Barr, Commander W. Briggs, P. Barry, F. Cumbers, R. Felgate, E. N. Clifton, H. Burroughes, Lieut.-Commander H. E. Perrin.

A.D.C. takes over Martinsyde Aircraft.

WE learn that negotiations have just been completed for the purchase, by the Aircraft Disposal Company, Ltd., of Regent House, Kingsway, of the manufacturing rights, goodwill, stock, &c., of Martinsyde aircraft of Woking. It is, of course, well known that the A.D.C. has done a great deal of business with Martinsyde machines, large numbers of which have been supplied to different countries. By purchasing the manufacturing rights of Martinsyde aircraft, the A.D.C. will be able to continue and maintain the very high standard of efficiency and the good name which these machines have always held in British as well as in foreign air services. We gather that it is the intention of the A.D.C. to take up original design and construction, and the stocks, plant, &c., will be transferred from the Woking works to the large A.D.C. factory at Waddon, Croydon, where future work will be carried on.

Supermarines for Spain

THE 12 aeroplanes which the Spanish Royal Naval Air Service decided to purchase from Great Britain, as reported in FLIGHT for February 14, are, we understand, a new type of supermarine amphibian flying-boat.

FLIGHT

AIR DEFENCE IN PARLIAMENT

ON February 19 the late Minister for Air, Lieut.-Col. Sir Samuel Hoare, moved the following resolution :—

"That this House, whilst earnestly desiring the further limitation of armaments so far as is consistent with the safety and integrity of the Empire, affirms the principle laid down by the late Government and accepted by the Imperial Conference that Great Britain must maintain a Home Defence Air Force of sufficient strength to give adequate protection against air attack by the strongest air force within striking distance of her shores."

In moving the resolution, Sir Samuel Hoare said he would like to make two over-riding observations, which should be read into everything he said. One was that he wished to make it quite clear that in making comparisons with the air force of France there was no suggestion, disguised or undisguised, of hostility towards our friends and Allies, and that he was not suggesting that a breach in the friendly relations between the two countries was likely. The second observation was that he was just as apprehensive as any member of the House in seeing a possibility of a new armaments race starting, and provided that in the meanwhile no risk was taken with our national defence he was prepared to look sympathetically at any attempt the Government might make to bring about a general reduction of armaments. He thought the Prime Minister was wise the other day when he said that an international conference must come at the end and not at the beginning of negotiations. As to a treaty of mutual guarantee, he would like to say a word of caution. There was a risk that in entering upon such a treaty we might be increasing and not diminishing our commitments. The Conservative party was just as anxious as the other parties to see a limitation of armaments, provided that limitation could be general, and provided also that it was consistent with the safety of the British Empire.

He could not help thinking that the Prime Minister, when he entered upon the many difficult negotiations that were before him, would find that it was not a disadvantage, at any rate, to have behind him a supreme Navy, and that it was not an advantage to have behind him an Air Force which, while it was excellent in quality, was altogether insignificant in quantity.

He wished to press the Government to define their attitude on what he regarded as the most urgent, and least controversial, aspect of national defence, the question of air defence.

He said advisedly the least controversial and the most urgent question of national defence, because he could not believe that there was any substantial section of members in the House that could regard with equanimity the fact that the capital of the Empire and the shores of this country were in so vulnerable a condition against the most terrible of modern attacks in warfare.

Sir Samuel Hoare then outlined the air position today, and went back to the time when the late Government took office eighteen months ago.

He became Secretary of State for Air in October, 1922, just at the most critical time of the Chanak crisis. At that moment we had within these shores only 24 first-line aeroplanes, trained and available for home defence. Owing to certain action which the late Government took, we had now about 80 first-line machines definitely allocated to home defence.

At the present moment there were in France about 1,000 first-line aeroplanes. Of these about 600 were included in what was known as the French Independent Striking Force. Then there were another 400 over and above this figure that were allocated to duties with the French Army. Speaking generally and not going into details, it was true to say that there were in France at the present moment about 1,000 first-line machines against a little more than 100 in this country. If you took the figures of the French Independent Striking Force, you had 600 machines as compared with our 80 home defence machines. If you added a certain number of the army co-operation machines, the comparison was between 1,000 and 100. Every hon. member would agree that that was a striking disparity, and he wondered whether all hon. members realised fully its significance.

During the War the greatest amount of bombs that was ever dropped upon these shores, in the space of a single month was 12 tons. Eight hundred machines could drop 170 tons of bombs upon London, not in the course of a month, but in the course of 24 hours, and keep up a bomb attack of 57 tons per day for an indefinite period. He would draw attention to a most interesting book that had just been published by a most distinguished French airman, M. René Fonck, not only a great war pilot, but a very influential member of the Chamber of Deputies, the Chairman of the French Aeronautic League. M. Fonck calculated that a force of 500 aeroplanes could, in the space of a single night, obliterate from the face of the earth a city a kilometre square. He calculated, further, that a force of this size could wipe off the surface of the globe a city as big as Paris in the course of a fortnight or three weeks. He thought that those two or three examples should be sufficient to impress upon every hon. member the gravity of the question and the extreme urgency of this aspect of the problem of national defence.

As soon as he became responsible for the Air Force, he put these facts before the then Prime Minister, Mr. Bonar Law, and the result was that they set in motion the comparatively small scheme of expansion that was initiated in the time of the right hon. Member for Stroud (Captain Guest). But it was quite obvious that that expansion was not sufficient. On that account Mr. Bonar Law appointed a Committee of Investigation of the Committee of Imperial Defence. The result of that inquiry was announced to the House last June. The Government accepted the principle embodied in his resolution, that, however improbable war might be, none the less, a country like ours could not afford to be in so vulnerable a position, and that, therefore, an Air Force must be built up sufficient to defend these shore from any possible air attack.

He at once took action and set on foot a programme for carrying the principle into effect. As a first stage of expansion they agreed upon an increase of the Air Force for the purpose of home defence which would bring it up to a strength of 600 first-line machines. That was a strength of 52 squadrons, devoted primarily to home defence.

The first question that he wished to ask the Government was, were they going on with that expansion for home defence or were they not? The House must keep in mind the fact that, however insistently they pressed on with this expansion, it must, in the nature of things, take a considerable time.

He therefore wanted to ask the Government whether they were going to press on with it as strongly as he was attempting to press on with it while he was in office? Were they going on with his programme of buying aerodromes? Were they going on with his programme of enlisting larger numbers of boys? Were they going on with his programme of ordering machines? On all these points he should like as clear an answer as the Government could give. Then there was another question. Was the Government going to adopt the general principle which he was attempting to apply to the constitution of the force? This, he would remind the House, was a force for home defence, a force that it was not intended to take to the more distant parts of the Empire on garrison duty, and because it was a home defence force based upon these shores you could apply to it methods of recruitment and training that you would not apply to a force that might be going, say, to India or Iraq. On that ground he embodied in his programme large elements of what he would call non-regular personnel for these home defence squadrons. In his programme there was to be a nucleus of regular squadrons, but there were also to be squadrons rather in the nature of territorial squadrons, to be called auxiliary Air Force squadrons, and, in addition, there were to be special reserve squadrons. Besides that, they intended to carry out as much of the non-flying duties as possible by civilian labour.

He should like to ask the Government, as his second question : Were they going to continue this general framework of non-regular personnel in addition to regular personnel, and, if they were going to continue it, were they going to introduce without delay the Auxiliary Air Force Bill?

While he was in office he did what he could, side by side with this military expansion, to develop civil aviation in various ways, and perhaps the most conspicuous way was by bringing together the various small civil aviation transport enterprises into a strong company. Before he left office, an agreement was signed between the Government and the new enterprise.

He would be assured if the Under-Secretary of State for Air would confirm his belief, namely, that this Government was just as anxious as the last Government to see civil aviation developing, and to see it put upon such a basis that in the future it would not longer be spoon-fed and dependent upon subsidies, but would be built to stand upon its own footing and develop, just like any other economic enterprise, and gradually drive its lines across the whole face of Europe.

Lastly—and he did not wish to labour this side of the question—he would like to say something with reference to the development of airships. He believed, if civil airships were developed just in the same way as civil aeroplanes, they would gradually build up a reserve both of skilled personnel and technical material which might stand them in very good stead at a time of emergency.

He would not say more than this at present—that they would think it most regrettable if, after these months of investigation and years of negotiation, the scheme of airship development upon which they were virtually agreed when they went out of office should be held up, and that there should be another long period during which no airship development was taking place.

The whole of this programme, a programme under which the British Air Force was going to be doubled, was, when the full expenditure came into being—not this year, but in future years—not going to amount to more than between £5,000,000 and £6,000,000 a year. That might be a great sum, but, at any rate, it was a very small sum as compared with the far larger sums spent upon other branches of national defence.

In conclusion Sir Samuel said : "Perhaps more important than that, this resolution is almost word for word the resolution agreed to by the Imperial Conference, and I can tell the House that in all the field of national defence that was surveyed by the Dominion Premiers, there was none that excited more interest, there was none that occasioned more anxiety, than the question of air defence. Therefore, I would press upon the House that they should accept this resolution this evening, a resolution which, as I say, calls for the very barest minimum of Air Force defence, a resolution which was agreed to by the Dominion Premiers at the Imperial Conference, and a resolution that, in my view, embodies a policy and a programme that is more vitally urgent to the safety of the country than any other phase of national defence at the present moment."

The Under-Secretary of State for Air (Mr. Leach) said he must admit that Sir Samuel Hoare had put his case with very much temperance of speech, and he would seek to meet the request for information from the Government. Sir Samuel had drawn a very alarming picture of the disparity of the Force between ourselves and France. Whether that be so or not, the responsibility did not lie with them. It was their legacy and not their responsibility, but for the moment he must decline to be alarmed about it. He was glad to hear the right hon. gentleman tell of his earnest desire for a further limitation of armaments, consistent, as he put it, with the safety and integrity of the Empire. Everybody wanted a decrease of armaments, perhaps even the armament makers. Everybody in the world wanted less armaments. The extraordinary thing was that what everybody wanted nobody could have. The one thing that was knocked on the head during the War was the doctrine that in order to get peace we must be prepared for war. All the nations in the world that prepared most got the most war. Preparedness was not the best weapon in diplomacy. The best weapon in diplomacy was to have a sound and righteous cause. He always thought that preparedness indicated a fear of one's neighbours, a disbelief in the righteousness of the intentions of those neighbours. He was not a disbeliever in the righteousness of France's intentions.

He was reminded by this resolution of an ancient military slogan : "Trust in God, but keep your powder dry." It was a cynical motto. Two thousand years ago, a great reformer laid down the principles for solving this problem of national defence. Most unfortunately, nobody accepted His views on the matter. They were buried with Him. Mr. Leach wanted to see some new excavation works to raise the lid of the Sarcophagus of the New Testament. He believed a new Gospel was needed, and suggested that if you wanted peace, you must prepare for peace.

The right hon. and gallant gentleman had asked in plain, explicit terms were they going on with the expansion scheme? He (Mr. Leach) was going to tell him in plain and explicit terms that there was no change in the policy of the Government for the time being on this matter. That plan for the time being would not be interfered with. Continuity had been agreed to by the Government.

The scheme itself was being worked out in definite stages, and it would not debar them from taking full advantage of any new movement in the direction of disarmament, or in the reduction of armaments. They would welcome a new Washington Conference, and would do what in them lay to make such a Conference possible. The Treaty of Mutual Guarantees proposed by the Temporary Mixed Commission of the League of Nations was already in draft. It was now being considered by the various Governments. If tha Treaty be approved, reductions would presumably be practicable.

The right hon. gentleman who had moved the resolution had pointed out the difficulties which stood in the way of quick increase of air squadrons. The scheme was going forward, and any deviation from it, if contemplated by this Government, would be brought before the House, and would have to be sanctioned there.

As regard the Auxiliary Air Force, Mr. Leach said that that scheme was going forward. The Auxiliary Air Force and the Air Force Reserve Bill was on the list of essential Bills to be submitted to the House. Concerning the question what steps were being taken in regard to ordering machines of a new type to meet the requirements of this new force, he said that the whole scheme was growing up in regular and definite stages, and sufficient machines were being ordered to equip those squadrons that would come into being during the coming year. It must be borne in mind that during the formation of the squadrons, and pending the delivery of the new machines, some of the squadrons would, for the time being, have only training machines and present types of service machines. Time would remedy that.

In regard to civil aviation and the proposals for bringing four companies

into one Imperial Transport Company. That agreement had been signed. It was a *fait accompli*. This legacy, also, so far as the present Government could do so, would be properly fulfilled. They were anxious to foster civil aviation and would take whatever measures were open to them to do so. In regard to airships, they were vitally interested in seeing that the lighter-than-air ships should be explored, encouraged and fostered in every proper way that was open to them.

The second part of the resolution called for a home defence Air Force sufficiently strong to provide an adequate protection against the strongest air force that was likely to be within striking distance of our shores. He supposed that on that as a pious declaration little criticism could be made; but he had wondered whether it was a practical proposition?

Could aeroplanes give adequate protection against aeroplanes? Everybody knew they could not. If we had 50 machines to 1 against the strongest, air force within striking distance, we would not be adequately protected, in the opinion of some people, and if we were ringed round from the Humber to the Thames, and around the South Coast to Cornwall, with machines every hundred yards, there would be somebody still saying that this was not adequate protection.

The only adequate defence that he could see was a changed international atmosphere. If we continued to put fear at the helm and folly at the prow we should steer straight for the next war.

Major-General Seely said they had listened to a most astounding doctrine given at the close of the speech of the Under-Secretary, a doctrine which, if followed to its logical conclusion, would really mean the disbandment of our Army and of our Navy, and of our Air Force, too. They must challenge the Government on that point of view. The Under-Secretary had asked: "What was the defence against aeroplanes?" He answered that by saying a change in the international spirit. Who were the aggressors? Who had been the aggressors? This country or others? This country had not been, and was not now, an aggressive country. We were forced into the late War.

We had throughout endeavoured to pursue a peaceful policy, and should continue to do so, but if we were to be told from the Treasury Bench that we were to rely for our national safety on a change in the international spirit without the provision of adequate defence provided by the House, then he challenged the Government. There was a real danger to this country owing to the new methods of air attack, a subject which he had studied to the best of his ability for many years. So far as he had been able to ascertain from every source, the facts were these: During the late War, as the late Secretary for Air said, the greatest weight of bombs dropped upon this country in any one month was 12 tons. He spoke now of France, not because there was any chance that France would attack this country. Indeed, he was quite sure that if this motion were accepted by the Government and acted upon, that no one would be more delighted than the French nation and Marshal Foch.

A year ago the French had it in their power had they been our enemy instead of our Ally and greatest friend, to drop upon any selected point more than ten times the weight in bombs, in one raid, than the Germans dropped in one month. He suggested considering it in the form of casualties to human beings. It could be said with certainty that not less than 100 casualties would follow every ton of bombs dropped. It followed that, assuming the force to which he had referred to be capable of dropping 90 per cent. of its available bomb-dropping power in the first raid, 75 per cent. in the next, and from 45 to 50 per cent. for successive days, in the absence of an adequate force to prevent it, then in the first raid there would be 12,600 casualties; in the second there would be 10,000; and for an indefinite period thereafter there would be from 8,000 to 9,000 casualties daily, certainly and unavoidably. If such a force were employed to set fire to a town, in the absence of an adequate Air Force this could not be prevented. If, as a third alternative, the very modest force in question were used to attack railway centres, it was quite certain that trains would cease to run and that London could not be fed. The result of an attack by air, in the absence of an adequate Air Force, would be that London would have to be evacuated within a few days. The Under-Secretary of State for Air had asked what was the defence. Were they going to have an aeroplane every hundred yards around the coast? Surely he (the Under-Secretary) must see that in this new and disastrous phase it was, alas, a matter of reprisals. If the question was asked what was the answer to an aeroplane, the reply would be "There is no other answer but another aeroplane."

Mr. B. Turner: "There is an answer—the New Testament."

Major-General Seely, continuing, said that the motion contained two sections. First, the limitation of armaments, and, secondly, an adequate Air Force. He said that unless they accepted the second they would never get the first. The reason why we managed to come to an agreement with America on the limitation of naval armaments was that everybody knew we had nothing to fear. We should not get the Powers of the world to agree to limitation of air armaments, even more necessary, unless we could say in regard to the air that we had nothing to fear. Lastly, General Seely said, they made the appeal in the interests of Imperial safety. The British Empire could not survive if this country was destroyed. He appealed to the Colonial Secretary to see whether the Dominions and India could not co-operate with us in the question of an adequate air defence.

Mr. Wallhead said he would ask succeeding speakers to tell him from whom they apprehended this danger. Germany, by the Treaty of Versailles, was wiped out as a possible danger so far as air attack was concerned. They could not say that any of the Scandinavian countries, Switzerland, Belgium or Holland constituted a danger to this country, and he did not think anyone would argue that there was a danger of these small countries uniting against us. Then the only possible danger was France, and if they could eliminate in Europe all possible opponents, leaving only our present ally France, then surely it ought to be possible so to arrange matters between France and ourselves that all possible danger was removed. He was aware that it took more than one to make a bargain, but somebody had to make the attempt. From what the last speaker had said it was obvious that we were hopelessly inferior to France, and it was doubtful if we could catch up to France if we started now. He said it was time that from the House a gesture should go forth to indicate that at least we were prepared to act, and not use mere words.

Captain Eden thought we should prepare to defend ourselves against an attack from any quarter. He hoped the Government would not be tempted too much by sentiment, but would rather act in accordance with the programme inherited from other parties, and that they would, as a matter of insurance, protect the country from attacks from the air. The Under-Secretary had asked what was meant by adequate protection, and had said he believed preparedness was not a good weapon. That might be, but unpreparedness was a very much worse weapon. The Under-Secretary had quoted one old military maxim. He (Capt. Eden) would quote another: "Attack is the best possible form of defence." He did not suggest that we should drop our bombs on other countries, but simply that we should have the means at our disposal to answer attack by attack.

Capt. Wedgwood Benn said the only way to prevent air attack was by doing the same thing to other people. He was surprised that the Government was prepared to go on with the programme which the right hon. gentleman (Sir Samuel Hoare) initiated. He was surprised because six months ago the Labour Party pledged themselves in their Conference to oppose it. He thought, however, they were right, but nobody pretended that the programme of Sir Samuel Hoare was an effective answer, numerically, to the French programme. Thirty-nine squadrons was no answer to 126 French squadrons. He would ask the Secretary of State for the Colonies whether the Government would accept the theory that there was a pool of money for national defence which was limited in character, and that if it appeared that modern warfare was better conducted by air than by sea or land, were they prepared to see that any necessary increase in air expenditure was not met by increased taxation, but by economies in the other departments?

His second point was to ask whether the Government were taking practical steps to utilise the Air Force to the best advantage. There were eight squadrons in Iraq; was it the intention to bring those squadrons home at the earliest possible moment? He also asked the Government what practical steps they were taking to put the policy into operation. There was the Pact of Mutual Guarantee. Had we replied? Some countries had. Was the Government proposing to examine it, and were they inclined to use the only practical method that had yet been suggested? In the schedule of that pact there would have to be a table of the Air Force which we proposed to permit ourselves. How were they to distinguish between fighting machines and civilian machines? He thought if anything were done to cripple civil aviation they would take a step against peace. Aviation was, in his opinion, capable of becoming one of the greatest agencies for peace in the world.

Lieut.-Commander Burney said the Member for Merthyr (Mr. Wallhead) appeared to think you could take a fully-developed Air Force our of your head like a conjurer. An Air Force must be built up over a series of years. One had to look upon the provision of an Air Force in the same way as upon paying one's fire insurance premium. He said they appeared to be between two courses. One was that they had to maintain their supremacy until such time as they could get disarmament, and the other was to develop some system of government throughout the civilised world in which disarmament would be possible. It was because the Navy and Army were cheap to maintain that they had been able to build up the Empire at comparatively small cost. Now science had brought in a new element, and they had to bear the continental as well as the Imperial burden. The former would have to be supported until such time as the Government were able to develop their disarmament policy. As regards the latter, he thought we should make the Dominions do their share of the economic upkeep or our defence forces. He would direct the attention of the Under-Secretary for Air to the absolute necessity of speeding up our air communications, which would be one of the vital factors towards binding our Empire together.

The Secretary of State for the Colonies (Mr. J. H. Thomas) said that while they must endeavour to be practical they must at the same time keep clearly at the back of their minds that the object of all people must be in the direction of peace and disarmament. They were not going to ask the House to accept the motion for reasons which he proposed to give. He paid a tribute to Sir Samuel Hoare for his speech, and also for his remarkable ability and efforts in connection with the particular problem of air defence. At the same time, he would point out that the resolution was inconsistent with his own (Sir Samuel Hoare's) policy. If there had been no change of Government and he (Sir Samuel Hoare) was giving effect to his own policy, the latter part of the resolution would not be fulfilled. He wanted the House to understand why the Government could not possibly accept the motion. Supposing, he said, that Sir Samuel Hoare was still Air Minister, and that full effect were given to the policy which he had laid down. In four years' time, assuming that France did not build one solitary additional aeroplane, when full effect had been given to the policy, and all the money had been spent, we should still then only be in possession of something like four-fifths of the striking force of the French. On policy he (Mr. Thomas) said clearly and definitely that there was no break in the first continuity of their policy. The first stage was going on, and there had been no break whatever. The two Bills were being introduced and pressed at an early stage, and their importance was fully recognised. But the Government wanted to survey the whole question, which was not one of the air only, but one involving the Navy and the Army. There would be no disarmament until confidence was established, and their first efforts would be to establish confidence. The Air Estimates would be put down at any date when the Opposition felt that they would like them discussed, and a full, definite statement on the whole policy would be given.

Rear-Admiral Sueter expressed surprise at the speech of the Under-Secretary of State for Air. He said that if they had carried out before the War the policy of the Under-Secretary for Air, they would have lost the War. Before the War they had very great difficulty in building up an air service, and at the end of the War they had the finest air service in the world. He asked what had become of that wonderful air service. He pointed out that in the current financial year, out of the 122 million pounds for defence the Air Service only got 12 millions. He submitted to the Under-Secretary for Air, and asked him to pass it on to the Secretary of State, that he must press for an equal proportion of the money available. With regard to airships, Admiral Sueter warned them that if they risked men's lives in old airships it would be a disastrous policy. They had had an example of that recently in the case of the Dixmude. He would like to say a few words on accidents. They were, he said, having far too many accidents with aeroplanes. During the early days of the air service they had fewer accidents in the Naval wing than in the Military wing, and he attributed that to the skill of the mechanics. He would like the Under-Secretary for Air to give his attention to this point of looking after the machines properly.

Lieut.-Commander Kenworthy asked how they expected to defend great cities by aeroplanes from the attacks of other aeroplanes at night. He would also like to point out to the Under Secretary for Air that while you were defending one city, the enemy would probably find out where your defences were and attack places where aeroplanes were not concentrated. The conclusion he reached was that the only sound strategy was to attack the other people. It therefore came to this, that we could not defend our cities by aeroplane. We might invent other scientific devices, but by aeroplane they could not defend the great cities. They built up a force sufficiently strong to threaten the nerve centres of possible enemies, and then they got people in the French Chamber or Beligian Chamber starting debates and pointing to the air force we had raised here, and once more they started on the wicked race for armaments which always ended in war. At the staff colleges two favourite games were studied today. One was in connection with the defence of Singapore, the other was aerial war. He asked against whom? The strongest air power, that was against France. It was no use blinking the fact. The only remedy was to educate public opinion to such an extent that a remedy would be demanded, and there was only one remedy, and that was all-round disarmament and an international police force.

He suggested that they should have a United States of Europe in aerial matters. This was going to come, but the difference was that it might come before another great war—with Bolshevism—or it might come afterwards. If the peoples of Europe were again to experience the horrors of modern scientific aerial warfare, he was convinced they would rise in sheer desperation and overthrow the existing system of society. They then would get internationalism after a catastrophe which would probably mean the end of civilisation as they knew it. The alternative was to be sensible and to educate public opinion. He thought it necessary that they should be on good terms with the greatest country in Europe—Russia. Russia today

was in the mire, but she had a great population, and could become the greatest air power on the Continent of Europe. If they had to go to war she would be an extremely valuable ally.

Lieut.-Col. Moore-Brabazon said that if there was one thing which really was of importance to be derived from the late War, it was the change from two-dimensional to three dimensional warfare. They had had appeals for moral gestures with regard to disarmaments. He hoped the present Government would give all the moral gestures it could, but thought it unfair to the past Governments to deny them their moral gestures with regard to armament. If they took the three forces one by one, were we not, he asked, the first to give up conscription, and get back to our pre-War army? With regard to the Navy, did we not immediately comply with the Washington Conference? At the end of the War we had an Air Force by a great deal transcending any Air Force in the world, and within eighteen months it had shrunk to be almost insignificant. What had been the result from the point of view of the air on the part of France? Those great moral gestures of disarmament brought about a proportion of power of 12 to 1 against us. On that basis it seemed to him that moral gestures were not a very efficient way of getting disarmament. There were two ways of limiting armament. One of them was to stop your opponent building against you. They would welcome everything the Government could do, in order to stop powers abroad building these big armaments against us. But if you could not stop it what else were you to do as a great nation, but build against them?

Mr. J. H. Thomas asked was it not true that the programme of the late Secretary for Air was to have been accomplished in four years, and that there was no indication by the late Government that they would go further?

Sir S. Hoare said he might say that that was not the intention of the late Government, which made it perfectly plain that this was the first stage in a much bigger programme, and that they had hoped, when they had carried through the first stage, that they would find that change in the atmosphere of Europe that would make it unnecessary to go on to the ultimate.

Mr. Thomas said that was exactly the position of the present Government. They accepted the first stage, and in going on with that they wanted to be free to see, when the change came, what could best follow.

Mr. Thurtle said he viewed the position of the Treasury Bench and the attitude of the Government with a certain amount of misgiving. He did think they might expect from a Labour Government that there would be a certain firmness of principle in regard to the matter of disarmament. They were told that the Government was to stand by the programme which had been laid down by the past Government. There was, in his opinion, no justification for a Labour Government, pledged as the present Treasury Bench was pledged to the principle of disarmament, taking up an attitude of that kind. He wanted to put a new point of view to the House. The whole idea of this air defence force, he said, was to get into the minds of the people of this country the thought that they were to a certain extent secure from air attacks. He thought it undesirable that people should have that idea in their minds, because it had been pointed out that it could not be a real guarantee in any case. He conceived that there might be in war itself its own antidote. If the people of this country could get into their minds that in a war in the future not only the fighting forces would be involved, but practically the whole of the population, he believed they would think very hard and very long before they decided upon war.

Capt. Guest thought the debate had been unsatisfactory. They had listened to a most moderate statement by the late Secretary of State for Air. He thought the Under-Secretary for Air replied in terms which left them in grave doubt as to what the Government were going to do. They had heard from the Colonial Secretary (Mr. Thomas) that the Government intended to oppose the resolution, and must therefore scan the reasons for the Government's position.

Sir Samuel Hoare claimed to move "that the question be now put," but Mr. Speaker withheld his assent, giving as his reason that the debate, on a matter of such magnitude, ought to be resumed when the Air Estimates for the year were before them.

IN PARLIAMENT

Imperial Airship Scheme

LIEUT.-COMMANDER KENWORTHY on February 21 asked the Under-Secretary of State for Air if there is any new development that is preventing the completion of the negotiations in regard to the Imperial airship scheme; and what is his policy with regard to this scheme?

Mr. Wells asked if, in view of the fact that the Imperial airship scheme has been under consideration of the Department concerned for nearly two years, has been approved, and the main contracts agreed to by the late Government, he will endeavour to get an early decision on this matter; and whether he will make a statement as to the Government's proposals regarding this scheme?

Mr. Leach: I am not at present in a position to add anything to the reply given on February 18 by the Prime Minister to the Member for Maidstone, but the Government are fully alive to the need for an early decision in this matter.

Tangmere Aerodrome

LIEUT.-COL. RUDKIN asked the Under-Secretary of State for Air when he proposes to put in hand the work of the Tangmere aerodrome?

Mr. Leach: Detailed plans and estimates are at present being prepared, and it is hoped to place a contract for the work early in July.

Air Transport Companies

MAJOR ROPNER, on February 25, asked the Prime Minister whether it is the intention of the Government to pay subsidies to air transport companies in the Colonies which are outside the scope of the Imperial Air Transport Co.; and whether the Government will make grants to Colonial Governments to assist in the establishment of air lines in the Colonies?

The Prime Minister: There is at present no intention on the part of His Majesty's Government to pay subsidies to air transport companies in the Colonies or to make grants to Colonial Governments towards the support of Colonial air lines.

Imperial Airship Scheme

MR. WELLS asked the Prime Minister when he will be prepared to give information as to the policy of the Government in respect of the Imperial airship scheme?

The Prime Minister: A special Sub-Committee of the Cabinet has been appointed to examine and report on this question. His Majesty's Government are fully alive to the importance of reaching an early decision, but it must have time to do its work thoroughly so that its conclusions will be sound.

Royal Air Force (Palestine)

DR. SPERO asked the Under-Secretary of State for Air the number of the Air Force personnel employed exclusively in Palestine, and if this personnel involves any addition to the total numbers figuring in the Air Force Estimates?

Mr. Leach: The latest figure for Royal Air Force personnel in Palestine is 646, all ranks. The answer to the second part of the question is in the negative.

THE ROYAL AIR FORCE

London Gazette, February 19, 1924.

General Duties Branch.

H. W. Taylor is granted short-service commn. as Flying Officer, with effect from and with seny. of Feb. 11; G. R. A. Pallin is granted a short service commn. as a Pilot Officer on probation, with effect from and with seny. of Jan. 31; Flight-Lieut. A. B. Ellwood, D.S.C., is placed on half-pay, Scale B, from Jan. 1 to Feb. 13, inclusive (substituted for *Gazette*, Jan. 8).

Reserve of Air Force Officers.

The following are granted commns. on probation in General Duties Branch in ranks stated (Feb. 19) :—

Class A.—FLYING OFFICERS.—O. P. Jones, A. S. Wilcockson, R. M. H. Young.

PILOT OFFICER.—G. T. E. B. Dorman.

Class A.A.—PILOT OFFICER.—S. J. Wheeler.

The following officers are confirmed in rank, with effect from the dates indicated :—

FLYING OFFICERS: A. M. Anderson, D.F.C., C. H. Graham (Jan. 29); M. N. Hancocks (Feb. 1); R. Jarman, D.S.C. (Feb. 2); S. Jones, D.F.C. (Feb. 14).

PILOT OFFICERS.—I. J. Sankey, E. F. Smith (Feb. 14.)

ROYAL AIR FORCE INTELLIGENCE

Appointments.—The following appointments in the R.A.F. are notified :—

General Duties Branch

Wing Commanders: C. D. Breese, A.F.C., to R.A.F. Depot, pending disposal on transfer to Home Estab. 26.1.24. E. M. Murray, D.S.O., M.C., to No. 1 Wing Hqrs., India, to command 10.1.24. A. ap Ellis, to Hqrs., Iraq Command, for Personnel Staff duties. 9.1.24. C. D. Breese, A.F.C., to No. 3 Group Hqrs., Spittlegate, for Tech. Staff duties. 1.3.24.

Squadron Leaders: R. M. Field, to No. 1 Group H.Q., Kenley. 3.3.24. F. Sowrey, D.S.O., M.C., A.F.C., to No. 8 Sqdn., Iraq, to command. 5.2.24. C. B. Cooke, to No. 20 Sqd., India, to command. 25.1.24.

Flight Lieutenants: R. T. B. Houghton, A.F.C., to No. 56 Sqdn., Biggin Hill. 28.2.24. A. B. Ellwood, D.S.C., to No. 1 Sch. of Tech. Training (Boys), Halton. 14.2.24. R. J. Sanceau, to H.Q. Egypt. 15.2.24. G. R. A. Deacon, M.C., to Sch. of Army Co-operation, Old Sarum. 25.2.24. C. A. Stevens, M.C., to R.A.F., Depot. 1.3.24. H. V. Rowley, to No. 84 Sqdn., Iraq. 19.1.24. P. H. Davy, to Aircraft Park, India. 26.1.24. N. S. Douglas, to H.Q., Inland Area. 25.2.24. G. H. Reid, D.F.C., to R.A.F. Depot, Uxbridge. 1.3.24. M. H. Butler, D.F.C., to Inland Area Aircraft Depot, Henlow. 1.3.24. T. Le G. Pynches, to remain at Marine and Armament Experimental Establ., Isle of Grain, instead of to Aeroplane Experimental Establ. as previously notified.

Flying Officers: B. H. Cook, to Marine and Armament Experimental Estab., Isle of Grain. 18.2.24. G. L. Carter, to R.A.F. Cadet College, Cranwell. 3.3.24. H. J. Wykes, to R.A.F. Depot. 21.2.24. J. G. Western, M.B.E., to No. 4 Sqdn., S. Farnborough. 3.3.24. C. E. C. Penny, to No. 1 Sch. of Tech. Training (Boys), Halton. 28.2.24. N. Liddall, to No. 5 Armoured Car Coy., Iraq. 5.11.23. R. F. Browne, D.F.C., to remain at No. 8 Sqdn., Iraq, and not to No. 5 Armoured Car Co., as previously notified. H. Buxton, to Aircraft Depot, Iraq. 29.1.24. F. J. Knowler, to Aircraft Depot, Egypt. 18.1.24. T. Sullivan, to Hqrs., Iraq Command, instead of to Aircraft Depot, Iraq, as previously notified. 23.11.23. R. L. Edward, to No. 30 Sqdn., Iraq. 9.1.24. R. de L. Stedman, to R.A.F. Cadet College, Cranwell. 8.2.24. A. H. Klyens, to R.A.F. Depot, Uxbridge (Supy.), Non-effective Pool. 25.2.24. J. Duncan, to Boys' Wing, Cranwell. 1.3.24. P. Harris, to Marine and Armament Experimental Estab., Isle of Grain. 29.2.24. I. O'B. MacGregor and W. F. A. Preston, both to Schl. of Army Co-operation, Old Sarum. 14.3.24. J. N. D. Anderson, F. W. Barkley and H. C. Davies, all to No. 7 Sqdn., Bircham Newton. 14.3.24. I. E. Brodie, to No. 2 Flying Training Sch., Duxford. 8.3.24. L. H. Brooke, to R.A.F. Base, Gosport. 14.3.24. J. J. C. Cocks, to No. 7 Sqdn., Bircham Newton. 7.3.24. U. C. de Burgh, to No. 2 Flying Training Sch., Duxford. 14.3.24. H. G. Kirkman, to R.A.F. Base, Gosport. 8.3.24. O. C. Noel, to R.A.F. Base, Leuchars. 14.3.24. A. R. Prendergast, to No. 2 Flying Training Sch., Duxford. 26.2.24. G. H. Stainforth, to No. 2 Flying Training Sch. Duxford. 7.3.24. R. Stiven, to R.A.F. Base, Gosport. 8.3.24. V. J. Somerset-Thomas, to R.A.F. Base, Leuchars. 26.2.24. D. S. Cairnes, to No. 2 Flying Training Sch., Duxford. 11.3.24. J. F. V. Sugars, to No. 5 Flying Training Sch., Shotwick, for course of instruction on transfer to Home Estab. 3.3.24. H. C. Lee, to R.A.F. Depot, on appointment to a Short Service Commn. 20.2.24.

Pilot Officers: A. H. Grace and T. W. G. Cattell, both to No. 2 Flying Training Sch., Duxford. 26.2.24. V. J. Hatton, to No. 7 Sqdn., Bircham Newton. 14.3.24. W. D. Baxter, J. E. Doran-Webb, H. V. Kerckhove, M.C., and E. G. Whinney, all to No. 2 Flying Training Sch., Duxford. 14.3.24. R. A. A. Cole, to No. 11 Sqdn., Bircham Newton. 14.3.24. C. J. A. Delany, to R.A.F. Base, Leuchars. 8.3.24. J. E. Tomes, to No. 11 Sqdn., Bircham Newton. 26.2.24. B. L. Young, to No. 7 Sqdn., Bircham Newton. 26.2.24. S. A. Young, to No. 2 Flying Training Sch., Duxford. 8.3.24.

Stores Branch

Squadron Leader F. G. M. Williams, to Inland Area H.Q. 1.3.24.

Flight Lieutenant F. R. Wilkins, to Miscellaneous Details, Andover Station, 1.3.24.

AIR POST STAMPS

By DOUGLAS B. ARMSTRONG

Air Post on the River Plate

A NEW, and this time definitive, set of air post stamps was brought into use in Uruguay on January 1, 1924, coincident with the establishment of a regular air post service between Montevideo and Buenos Ayres by means of hydroplanes, operated by the River Plate Aviation Co. Early examples of these air post stamps have been shown us by Mr. Alan Turton. Lithographed in large square format at the Imprensa Nacional, the main feature of the design is a white aeroplane displayed upon a ground of solid colour within an uncoloured rectangular frame. The inscription, also in white lettering, reads "Correo Aereo — (value) R.O. del Uruguay" round the four sides of the stamp. There are three denominations, viz., 6 centimos blue, 10 c. red and 20 c. green, which are used in addition to ordinary postage stamps to defray the special air post fees according to weight.

No special air stamps are as yet in use by the Argentine postal authorities in connection with this service, although such an issue is by no means improbable. At present letters sent by air from Buenos Ayres to Montevideo are merely impressed with a large rectangular cachet, in black, reading "Servicio Postal—Aereo—Buenos Aires—Montevideo," in three lines.

Lithuania's New Air Stamps

A FIFTH series of aero stamps has just made its appearance in Lithuania, presumably in anticipation of early resumption of the North European air mail system which has been suspended during the winter months. The latest issue consists of four values, three of them in an impressionist design representing two pigeons with letters held in their beaks, and a tiny vignette of an aeroplane flying in the dawn. These are 20 cents yellow, 40 c. pale green and 60 c. rose. The fourth stamp, value 1 Litas chocolate, shows an aeroplane, the star and cap of Liberty, and the winged word "ORO." All are oblong in shape, printed by lithography upon paper watermarked with a honeycomb pattern an perforated 11.

Germany

THE new German air post stamps foreshadowed in our last notes are now to hand. A rare error of colour in the 1 mark value of the former series has been brought to our notice by Mr. R. E. R. Dalwick, the specimen in question being printed in orange instead of the normal green.

Air Stamps from Lebanon

THE set of French postage stamps overprinted "Poste Par Avion—Syrie Grand Liban," and recently noted in this column, has had a short life, having been superseded on January 1, 1924, by a similar issue overprinted "GRAND LIBAN" only (without the prefix "Syrie"). We understand that not more than 3,000 copies of the former were printed.

Hungary

IN May next a series of air post stamps of artistic aspect is announced to make its appearance in place of the postage types overprinted "Legi Posta," which have hitherto been employed in franking air post letters. The first Hungarian air stamps were issued on July 4, 1918, for use over a military air line between Vienna and Budapest, and were overprinted "Repulo Posta." After they had been in circulation for 19 days only the service was suspended owing to a series of mishaps. The present issue was introduced on November 8, 1920, in connection with a service linking the capital with other important Hungarian towns.

Esthonian Air Stamps

THE provisional surcharges upon the old original 5 marka air stamp which came into use in October last, have now given place to a permanent set of five denominations, lithographed in a triangular design reminiscent of that adopted in 1920, but with a modern passenger plane substituted for the old type of biplane in the central vignette. The inscription reads, as before, "EESTI OHU POST," and the values and colours of the five stamps are: 5 Marka, ochre and black; 10 Marka, blue and black; 15 Marka, red and black; 20 Marka, green and black; and 45 Marka, lilac and black. We have seen the new stamps obliterated with the Tallin postmark, dated 14.2.24.

Readers are inited to forward to the Editor of **FLIGHT** *letters, etc., bearing aerial stamps or postmarks for mention in this column, as well as out-of-the-way varieties, etc.*

We shall also be pleased to hear from correspondents interested in air-stamp collecting, and to answer any queries.

All About the "Bristol Lucifer"

AN extremely comprehensive booklet on the 100 h.p. "Bristol Lucifer" aero engine has just been produced by the Bristol Aeroplane Co., Ltd., of Filton. This booklet contains much interesting information—with illustrations—not only on the merits and achievements of the "Lucifer," but also on the constructional details and various noteworthy features of this successful power unit. The "Bristol Lucifer," which, as no doubt most of our readers know, is a three-cylinder radial air-cooled engine, has shown up remarkably well in aerial racing events, but it is primarily as a medium-powered engine of unequalled reliability, calling for little trouble and expense in upkeep, and having an exceptionally long and serviceable life, that the "Bristol Lucifer" stands out foremost. The Bristol Co. will be pleased to send copies of this booklet to anyone interested.

PUBLICATIONS RECEIVED

Business Value of Publicity Clubs.—The Publicity Club of London, Hotel Cecil, London, W.C. 2.

Proof. No. 10. *February*, 1924.—Dobson Molle and Co., Ltd., St. Clair Works, Edinburgh.

Aeronautical Research Committee, Reports and Memoranda. No. 810 (*M.N.*4).—The Accuracy of Sextant Observations Taken from Aircraft. By B. M. Jones, M.A., A.F.C. May, 1922. Price 1*s.* net. *No.* 829 (*Ae.* 80).—Experiments with a Family of Airscrews: Part I. Experiments with Airscrews Mounted in Front of a Small Body. By A. Fage, C. N. H. Lock, R. G. Howard and H. Bateman. November, 1922. London: H.M. Stationery Office, Kingsway, W.C.2. Price 3*s.* 6*d.* net.

AERONAUTICAL PATENT SPECIFICATIONS

Abbreviations: cyl. = cylinder; I.C. = internal combustion; m. = motor

The numbers in brackets are those under which the Specifications will be printed and abridged, etc.

Applied for in 1922.

Published February, 28, 1924.

29,609. SOC. ANON. DES ATELIERS D'AVIATION L. BREGUET. Aeroplane construction. (188,650.)

34,567. ARMSTRONG SIDDELEY MOTORS, LTD., and J. LLOYD. Girders of box-like section for aircraft. (210,591.)

Applied for in 1923.

Published February 28, 1924.

3,717. G. GARIBALDI. Screw propellers. (210,630.)

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